



Patent  
Attorney's Docket No. 032619-030

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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Patent Application of )  
Oliver LEGENDRE et al. ) Group Art Unit: 1764  
Application No.: 08/914,244 ) Examiner: W. Griffin  
Filed: August 19, 1997 ) Appeal No.  
For: CATALYTIC TREATMENT OF )  
GASEOUS EFFLUENTS )  
CONTAINING VARYING )  
AMOUNTS OF SULFUR )  
COMPOUNDS )

## **BRIEF FOR APPELLANT**

Assistant Commissioner for Patents  
Washington, D.C. 20231

Sir:

This appeal is from the decision of the Primary Examiner dated August 15, 2000 (Paper No. 33), finally rejecting claims 1-23, which are reproduced as an Appendix to this brief.

The Commissioner is hereby authorized to charge [ ] \$150.00 (220) [X] \$300.00 (120) for the Government fee to Deposit Account No. 02-4800 and two extra copies of this brief are being filed herewith.

The Commissioner is hereby authorized to charge any appropriate fees under 37 C.F.R. §§1.16, 1.17, and 1.21 that may be required by this paper, and to credit any overpayment, to Deposit Account No. 02-4800. This paper is submitted in triplicate.

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I. **Real Party in Interest**

The present application is assigned to Institut Francais Du Petrole.

II. **Related Appeals and Interferences**

The Appellants' legal representative, or assignee does not know of any other appeal or interferences which will affect or be directly affected by or have bearing on the Board's decision in the pending appeal.

III. **Status of Claims**

Claims 1-23 stand rejected in the August 15, 2000 final Official action.

IV. **Status of Amendments**

No amendments to the claims have been filed subsequent to the August 15, 2000 final Official Action.

V. **Summary of the Invention**

The invention relates to novel catalysts for the purification/treatment of gases, especially of gaseous industrial effluents containing sulfur compounds, particularly to recover elemental sulfur therefrom, and more especially to novel catalysts for the Claus reaction and/or the hydrolysis of organic sulfur compounds (specification at page 1, lines 5-11). It has unexpectedly been determined that the extent of the sodium content of alumina is a primary factor in the deactivation thereof, especially by sulphate formation (specification at page 3, lines 11-14). According to the invention, a catalytically active alumina comprises sodium values wherein the sodium content of the alumina ranges from 1,200 to 2,500 ppm of Na<sub>2</sub>O by weight thereof (specification at page 3, lines 19-26).

The figure of the drawing is a graph plotting the conversion of CS<sub>2</sub> as a function of the Na<sub>2</sub>O content in various alumina catalysts (specification at page 4, lines 2-4). In Example 2, catalysts having various Na<sub>2</sub>O contents were prepared and the catalytic activity thereof was tested by contacting the catalysts with a gas having the composition set forth in

the table on page 9 of the specification. As shown in the figure, the conversion of CS<sub>2</sub> was unexpectedly improved when the Na<sub>2</sub>O range was limited to 1,200 to 2,500 ppm.

**VI. The Issues**

The three issues presented by this appeal are (1) the rejection of Claims 1-3, 7 and 11-21 under 35 U.S.C. §102(b) over U.S. Patent No. 4,364,858 ("Goodboy"), (2) the rejection of Claims 4-6, 8, 9, 22 and 23 under 35 U.S.C. §103 over Goodboy in view of U.S. Patent No. 5,244,648 ("Dupin") and (3) the rejection of Claim 10 under 35 U.S.C. §103 over Goodboy in view of U.S. Patent No. 5,242,673 ("Flytzani-Stephanopoulos").

**VII. Grouping of Claims**

Claims 1, 11, 12, 13, 14 and 15 are independent claims which recite the common feature of an activated alumina catalyst comprising a cocatalytically effective amount of sodium values wherein the effective amount, expressed by weight of Na<sub>2</sub>O, ranges from 1,200 ppm to 2,500 ppm (Claim 1) or 1,200 ppm to 2,700 ppm (Claims 11-15). If the Board of Patent Appeals and Interferences ("BPAI") agrees that Appellants have established that the claimed catalyst achieves unexpected results sufficient to rebut the obviousness rejection, then all claims should be allowable. If the BPAI affirms the rejection of Claim 1, it is submitted that the remaining claims do not fall with Claim 1 for the following reasons.

Claim 4 recites that the activated alumina catalyst as defined by Claim 1 further comprises silica and/or at least one oxide of titanium, zirconium, cerium, tin, a rare earth, molybdenum, cobalt, nickel or iron. In the Official Action, it is acknowledged that Goodboy "does not disclose that the catalyst further comprises the components in claims 4-6, does not disclose the bead sizes of claims 8, 9, and 22, and does not disclose the pore volume as claimed in claim 23" (Official Action at page 4). The Official Action includes a discussion of Dupin but does not specifically address Claim 4. Because Goodboy does not mention silica or "oxides" of Ti, Zr, Ce, Sn, a rare earth, Mo, Co, Ni or Fe and the Official Action does not apply Dupin in a manner which would cure the deficiencies of

Dupin, Claim 4 further patentably distinguishes the claimed invention over Goodboy in view of Dupin.

Claim 5 recites that the activated alumina catalyst as defined by Claim 1 further comprises a clay, a silicate, an alkaline earth metal or ammonium sulfate, ceramic fibers, asbestos fibers, or combination thereof. In the Official Action, it is acknowledged that Goodboy "does not disclose that the catalyst further comprises the components in claims 4-6, does not disclose the bead sizes of claims 8, 9, and 22, and does not disclose the pore volume as claimed in claim 23" (Official Action at page 4). The Official Action includes a discussion of Dupin but does not specifically address Claim 5. Because the Official Action does not apply Dupin in a manner which would cure the deficiencies of Dupin, Claim 5 further patentably distinguishes the claimed invention over Goodboy in view of Dupin.

Claim 6 recites that the activated alumina catalyst as defined by Claim 1 further comprises cellulose, carboxymethyl cellulose, carboxyethyl cellulose, tallol, a xanthan gum, a surface-active agent, a flocculating agent, a polyacrylamide, carbon black, a starch, stearic acid, polyacrylic alcohol, polyvinyl alcohol, a biopolymer, glucose, a polyethylene glycol, or combination thereof. In the Official Action, it is acknowledged that Goodboy "does not disclose that the catalyst further comprises the components in claims 4-6, does not disclose the bead sizes of claims 8, 9, and 22, and does not disclose the pore volume as claimed in claim 23" (Official Action at page 4). The Official Action includes a discussion of Dupin but does not specifically address Claim 6. Because the Official Action does not apply Dupin in a manner which would cure the deficiencies of Dupin, Claim 6 further patentably distinguishes the claimed invention over Goodboy in view of Dupin.

Claim 7 recites that the activated alumina catalyst as defined by Claim 1 comprises extrudates, tablets, or beads thereof. Goodboy discloses that the catalysts according to the Goodboy invention are used in fixed or mobile beds with the dimensions of the constituent grains being adapted to the particular situation (see column 7, lines 1-4 of Goodboy). In the Official Action, it is argued that Goodboy discloses "agglomerated particles (i.e., beads), the size of which can be adapted to a particular situation" (Official Action at page 2). The Official Action does not specifically address Claim 7. Because the Official Action

does not apply Goodboy in a manner which would produce the combination of features recited in Claim 7, Claim 7 further patentably distinguishes the claimed invention over Goodboy in view of Dupin.

Claim 8 recites that the activated alumina catalyst as defined by Claim 7 comprises a plurality of beads having a diameter size ranging from 1.5 mm to 10 mm. In the Official Action, it is acknowledged that Goodboy "does not disclose that the catalyst further comprises the components in claims 4-6, does not disclose the bead sizes of claims 8, 9, and 22, and does not disclose the pore volume as claimed in claim 23" (Official Action at page 4). The Official Action includes a discussion of Dupin but does not specifically address Claim 8. Because the Official Action does not apply Dupin in a manner which would cure the deficiencies of Dupin, Claim 8 further patentably distinguishes the claimed invention over Goodboy in view of Dupin.

Claim 9 recites that the beads as defined by Claim 8 have a diameter size ranging from 3 mm to 7 mm. In the Official Action, it is acknowledged that Goodboy "does not disclose that the catalyst further comprises the components in claims 4-6, does not disclose the bead sizes of claims 8, 9, and 22, and does not disclose the pore volume as claimed in claim 23" (Official Action at page 4). The Official Action includes a discussion of Dupin but does not specifically address Claim 9. Because the Official Action does not apply Dupin in a manner which would cure the deficiencies of Dupin, Claim 9 further patentably distinguishes the claimed invention over Goodboy in view of Dupin.

Claim 10 recites that the activated alumina catalyst as defined by Claim 1 is deposited onto a support substrate therefor. In the Official Action, it is acknowledged that Goodboy "does not disclose that the alumina catalyst is deposited on a support substrate" (Official Action at page 5). Flytzani-Stephanopolous is cited for a disclosure that "sulfur recovery catalysts that contain aluminum oxide may be deposited on supports" (Official Action at page 6). Although the Official Action argues that it would have been obvious to modify Goodboy "by supporting the catalyst as suggested by Flytzani-Stephanopolous" (Official Action at page 6), the result of such a modification of Goodboy would be an impermissible change in the principle of operation of Goodboy's catalyst. See MPEP §

2143.01 and 2145 III (page 2100-121). As such, the combination of features recited in Claim 10 further patentably distinguishes the claimed invention over the prior art.

Claim 11 recites a catalyst comprising at least 0.5% by weight of an activated alumina catalyst comprising a cocatalytically effective amount of sodium values, said effective amount, expressed by weight of Na<sub>2</sub>O, ranging from 1,200 ppm to 2,700 ppm. The Official Action contends that Goodboy's overlapping range of 1000 ppm to 25000 ppm anticipates the range recited in Claim 11. Because the position taken in the Official Action is contrary to well established legal precedent (see MPEP § 716.02 (d) "Nonobviousness Of A Genus Or Claimed Range May Be Supported By Data Showing Unexpected Results Of A Species Or Narrow Range Under Certain Circumstances" (page 700-157), the combination of features recited in Claim 11 further patentably distinguishes the claimed invention over the prior art.

Claim 12 recites a catalyst comprising from 60% to 99% by weight of activated alumina catalyst comprising a cocatalytically effective amount of sodium values, said effective amount, expressed by weight of Na<sub>2</sub>O, ranging from 1,200 ppm to 2,700 ppm. The Official Action contends that Goodboy's overlapping range of 1000 ppm to 25000 ppm anticipates the range recited in Claim 12. Because the position taken in the Official Action is contrary to well established legal precedent (see MPEP § 716.02 (d) "Nonobviousness Of A Genus Or Claimed Range May Be Supported By Data Showing Unexpected Results Of A Species Or Narrow Range Under Certain Circumstances" (page 700-157), the combination of features recited in Claim 12 further patentably distinguishes the claimed invention over the prior art.

Claim 13 recites a process wherein a catalyzed Claus reaction is used for the production of elemental sulfur, the improvement comprising using as the catalyst therefor, an activated alumina catalyst comprising a cocatalytically effective amount of sodium values, said effective amount, expressed by weight of Na<sub>2</sub>O, ranging from 1,200 ppm to 2,700 ppm. The Official Action alleges that Goodboy discloses a "Claus reaction" (Official Action at page 2) but does not specifically address Claim 13. As such, the combination of

features recited in Claim 13 further patentably distinguishes the claimed invention over the prior art.

Claim 14 recites a process for the catalyzed hydrolysis of an organosulfur compound wherein the improvement comprises using as the catalyst therefor, an activated alumina catalyst comprising a cocatalytically effective amount of sodium values, said effective amount, expressed by weight of  $\text{Na}_2\text{O}$ , ranging from 1,200 ppm to 2,700 ppm.

The Official Action alleges that Goodboy discloses "that hydrolysis of organic sulfur compounds occurs" (Official Action at page 3) but does not specifically address Claim 14. As such, the combination of features recited in Claim 14 further patentably distinguishes the claimed invention over the prior art.

Claim 15 recites a process for catalytically removing objectionable sulfur compounds from gaseous effluents comprised thereof wherein the improvement comprises using as the catalyst therefor, an activated alumina catalyst comprising a cocatalytically effective amount of sodium values, said effective amount, expressed by weight of  $\text{Na}_2\text{O}$ , ranging from 1,200 ppm to 2,700 ppm. The Official Action alleges that Goodboy "discloses a Claus reaction which necessarily results in the removal of sulfur compounds from gases" (sentence bridging pages 2-3 of Official Action) but does not specifically address Claim 15. As such, the combination of features recited in Claim 15 further patentably distinguishes the claimed invention over the prior art.

Claim 16 recites that the activated alumina catalyst as defined by Claim 1 has a specific surface of 350 to 370  $\text{m}^2/\text{g}$ . Although the Official Action alleges that "[i]t is desirable to have a specific surface greater than 300  $\text{m}^2/\text{g}$ " (Official Action at page 2), there is no teaching or suggestion in Goodboy to provide the activated alumina with a specific surface in the claimed range of 350 to 370  $\text{m}^2/\text{g}$ . As established by example 2 of Appellants' specification, when the specific surface is 360  $\text{m}^2/\text{g}$  ( $\pm 10 \text{ m}^2/\text{g}$ ), it is possible to achieve the unexpected improvement in conversion of  $\text{CS}_2$  set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nedezy ("the Nedezy Declaration") submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedezy Declaration is insufficient to overcome the rejection of Claim 1 on the

grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 16.

Claim 17 recites that the activated alumina catalyst as defined by Claim 11 has a specific surface of 350 to 370 m<sup>2</sup>/g. Although the Official Action alleges that “[i]t is desirable to have a specific surface greater than 300 m<sup>2</sup>/g” (Official Action at page 2), there is no suggestion in Goodboy to provide the activated alumina with a specific surface in the claimed range of 350 to 370 m<sup>2</sup>/g. As established by example 2 of Appellants’ specification, when the specific surface is 360 m<sup>2</sup>/g ( $\pm 10$  m<sup>2</sup>/g), it is possible to achieve the unexpected improvement in conversion of CS<sub>2</sub> set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nedez (“the Nedez Declaration”) submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedez Declaration is insufficient to overcome the rejection of Claim 1 on the grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 17.

Claim 18 recites that the activated alumina catalyst as defined by Claim 12 has a specific surface of 350 to 370 m<sup>2</sup>/g. Although the Official Action alleges that “[i]t is desirable to have a specific surface greater than 300 m<sup>2</sup>/g” (Official Action at page 2), there is no teaching or suggestion in Goodboy to provide the activated alumina with a specific surface in the claimed range of 350 to 370 m<sup>2</sup>/g. As established by example 2 of Appellants’ specification, when the specific surface is 360 m<sup>2</sup>/g ( $\pm 10$  m<sup>2</sup>/g), it is possible to achieve the unexpected improvement in conversion of CS<sub>2</sub> set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nedez (“the Nedez Declaration”) submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedez Declaration is insufficient to overcome the rejection of Claim 1 on the grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 18.

Claim 19 recites that the activated alumina catalyst as defined by Claim 13 has a specific surface of 350 to 370 m<sup>2</sup>/g. Although the Official Action alleges that “[i]t is desirable to have a specific surface greater than 300 m<sup>2</sup>/g” (Official Action at page 2), there is no teaching or suggestion in Goodboy to provide the activated alumina with a specific surface in the claimed range of 350 to 370 m<sup>2</sup>/g. As established by example 2 of Appellants’ specification, when the specific surface is 360 m<sup>2</sup>/g ( $\pm 10$  m<sup>2</sup>/g), it is possible to achieve the unexpected improvement in conversion of CS<sub>2</sub> set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nedez (“the Nedez Declaration”) submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedez Declaration is insufficient to overcome the rejection of Claim 1 on the grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 19.

Claim 20 recites that the activated alumina catalyst as defined by Claim 14 has a specific surface of 350 to 370 m<sup>2</sup>/g. Although the Official Action alleges that “[i]t is desirable to have a specific surface greater than 300 m<sup>2</sup>/g” (Official Action at page 2), there is no teaching or suggestion in Goodboy to provide the activated alumina with a specific surface in the claimed range of 350 to 370 m<sup>2</sup>/g. As established by example 2 of Appellants’ specification, when the specific surface is 360 m<sup>2</sup>/g ( $\pm 10$  m<sup>2</sup>/g), it is possible to achieve the unexpected improvement in conversion of CS<sub>2</sub> set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nedez (“the Nedez Declaration”) submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedez Declaration is insufficient to overcome the rejection of Claim 1 on the grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 20.

Claim 21 recites that the activated alumina catalyst as defined by Claim 15 has a specific surface of 350 to 370 m<sup>2</sup>/g. Although the Official Action alleges that “[i]t is desirable to have a specific surface greater than 300 m<sup>2</sup>/g” (Official Action at page 2), there

is no teaching or suggestion in Goodboy to provide the activated alumina with a specific surface in the claimed range of 350 to 370 m<sup>2</sup>/g. As established by example 2 of Appellants' specification, when the specific surface is 360 m<sup>2</sup>/g ( $\pm 10$  m<sup>2</sup>/g), it is possible to achieve the unexpected improvement in conversion of CS<sub>2</sub> set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nedez ("the Nedez Declaration") submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedez Declaration is insufficient to overcome the rejection of Claim 1 on the grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 21.

Claim 22 sets forth that the activated alumina catalyst as defined by Claim 1 comprises beads having a diameter of 3.1 to 6.3 mm and specific surface area of 350 to 370 m<sup>2</sup>/g. Claim 22 was rejected over the combination of Goodboy and Dupin. In the Official Action, it is acknowledged that Goodboy "does not disclose that the catalyst further comprises the components in claims 4-6, does not disclose the bead sizes of claims 8, 9, and 22, and does not disclose the pore volume as claimed in claim 23" (Official Action at page 4). The Official Action includes a discussion of Dupin but does not specifically address Claim 22. Because the Official Action does not apply Dupin in a manner which would cure the deficiencies of Dupin, Claim 22 further patentably distinguishes the claimed invention over Goodboy in view of Dupin. Further, as established by example 2 of Appellants' specification, when the specific surface is 360 m<sup>2</sup>/g ( $\pm 10$  m<sup>2</sup>/g) and the bead particle size is 3.1 to 6.3 mm, it is possible to achieve the unexpected improvement in conversion of CS<sub>2</sub> set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nedez ("the Nedez Declaration") submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedez Declaration is insufficient to overcome the rejection of Claim 1 on the grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 22.

Claim 23 sets forth that the activated alumina catalyst as defined by Claim 1 comprises beads having (a) pore volume of alumina of pores of diameter greater than 0.1  $\mu\text{m}$  of 18.5 ml/100g and (b) pore volume of pores of alumina of diameter greater than 1  $\mu\text{m}$  of 15.5 ml/100g. Claim 23 was rejected over the combination of Goodboy and Dupin. In the Official Action, it is acknowledged that Goodboy "does not disclose that the catalyst further comprises the components in claims 4-6, does not disclose the bead sizes of claims 8, 9, and 22, and does not disclose the pore volume as claimed in claim 23" (Official Action at page 4). The Official Action includes a discussion of Dupin but does not specifically address Claim 23. Because the Official Action does not apply Dupin in a manner which would cure the deficiencies of Dupin, Claim 23 further patentably distinguishes the claimed invention over Goodboy in view of Dupin. Further, as established by example 2 of Appellants' specification, when the pore volume of pores of diameter greater than 0.1  $\mu\text{m}$  is 18.5 ml/100 g of alumina and the pore volume of pores of diameter greater than 1  $\mu\text{m}$  is 15.5 ml/100 g of alumina, it is possible to achieve the unexpected improvement in conversion of  $\text{CS}_2$  set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nede (the Nede Declaration) submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nede Declaration is insufficient to overcome the rejection of Claim 1 on the grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nede Declaration is commensurate with the scope of Claim 23.

## **VIII. Argument I**

### **A. The §102 Rejection**

Claims 1-3, 7 and 11-21 were rejected under 35 U.S.C. §102(b) over U.S. Patent No. 4,364,858 ("Goodboy"). The rejection should be reversed for the following reasons.

**B. Standard for Overcoming § 102 Rejections**

In order to establish anticipation under §102(b), all elements of the claim must be found in a single reference. Hybritech, Inc. v. Monoclonal Antibodies, Inc., 231 USPQ 81, 90 (Fed. Cir. 1986), cert. denied, 107 S. Ct. 1606 (1987). In particular, as pointed out by the court in W.L. Gore & Assoc., Inc. v. Garlock, Inc., 220 USPQ 303, 313 (Fed. Cir. 1981), cert. denied, 469 U.S. 851 (1984), "anticipation requires that each and every element of the claimed invention be disclosed in a prior art reference." In the present case, Goodboy clearly fails to anticipate or render obvious the claimed subject matter.

The following cases establish that a broad range disclosed in a reference can be patentably distinguished over by a submission of comparative evidence showing unexpected results.

"[I]t is an established principle of law that a limitation merely with respect to proportions in a composition of matter or process will not support patentability unless such limitation is 'critical'." In re Cole, 140 USPQ 230, at 234 (CCPA 1964).

"Normally it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art." In re Aller et al., 105 USPQ 233, at 235 (CCPA 1955).

"It is well settled that a *prima facie* case of obviousness may be rebutted where the results of optimizing a variable, which was known to be result effective, [are] unexpectedly good." In re Boesch et al., 205 USPQ 215, at 219 (CCPA 1980).

"We think it sufficient to note that the range disclosed in Rule envelops the range claimed by Appellant, and that Appellant has produced no evidence tending to show superior results because of his selection of the narrower range within the disclosed range...absent a showing to the contrary, discovering particular ranges within a range disclosed by the prior art would be within the skill of the art." In re Reven, 156 USPQ 679, at 681 (CCPA 1968).

"The range specified in the appealed claims is much narrower and, although the two ranges overlap to a certain extent, such circumstance does not preclude the grant of a patent when the applicant satisfactorily establishes that the obtained results which are unobvious and unexpected and that his claims do not read upon a particular embodiment of the reference." Ex parte Thumm, 132 USPQ 66, at 68 (BPA 1960).

"It is well settled that proportions or values are critical only when they involve a difference in kind rather than in degree." In re Bourdon, 112 USPQ 323, at 325 (CCPA 1957).

"[I]f the prior art shows a range, as appellants apparently admit it does in this case, which includes the range claimed in their application, in the absence of the production of a different product they are not entitled to a patent." In re Cooper et al., 57 USPQ 117, at 119 (CCPA 1943).

"Appellant has raised an interesting question, however, by his citation of several cases wherein the prior art taught a broad range and the inventor was held entitled to claims limited to a narrow range within the broad range by showing criticality of and the existence of unexpected properties within the claimed range." In re Malagari, 182 USPQ 549, at 553 (CCPA 1974).

#### C. Subject Matter Set Forth In Claim 1 Compared to Goodboy

Claim 1 sets forth an activated alumina catalyst comprising a cocatalytically effective amount of sodium values wherein the effective amount, expressed by weight of Na<sub>2</sub>O, ranges from 1,200 ppm to 2,500 ppm. Goodboy, on the other hand, relates to an activated catalyst having an overlapping sodium oxide content for purposes of providing resistance to sulfate poisoning (column 3, lines 10-33 of Goodboy). Goodboy does not disclose any examples with sodium oxide contents within the claimed range. As such, Goodboy does not anticipate the invention defined by Claim 1.

Goodboy states that a high sodium oxide content is beneficial for achieving low CO<sub>2</sub> chemisorption and the preferred amount of Na<sub>2</sub>O is 5000 ppm and above (see column 3, line 54 through column 4, line 22 of Goodboy). Goodboy does not disclose any examples

of an activated alumina catalyst having a cocatalytically effective amount of sodium values for conversion of CS<sub>2</sub> wherein the effective amount is expressed by weight of Na<sub>2</sub>O ranging from 1200 to 2500 ppm. As such, Goodboy fails to disclose the combination of features recited in Claim 1.

**D. An Overlapping Range Does Not Establish Anticipation**

Overlapping ranges presents a §103 issue rather than a §102 issue. That is, according to MPEP §2131.03:

"If the claims are directed to a narrow range, the reference teaches a broad range, and there is evidence of unexpected results within the claimed narrow range, dependent on the other facts of the case, it may be reasonable to conclude that the narrow range is not disclosed with 'sufficient specificity' to constitute anticipation of the claims." (Emphasis Added)

In the present case, the Goodboy reference discloses a broad range of 0.1 to 2.5 wt. % sodium oxide and a preferred range of 0.50 to 2.5 wt. % (column 3, lines 57-60 of Goodboy). Applicants, on the other hand, claim a range of 1200 to 2500 ppm (0.12 to 0.25 %), i.e. a narrow range within Goodboy's broad range, and Applicants have submitted a showing of unexpected improvement in conversion of CS<sub>2</sub> over the claimed narrow range (see previously submitted Nedez Declaration). The claimed narrow range and the evidence of unexpected results, meets the conditions set forth in MPEP §2131.03 for overcoming an anticipation rejection over a reference disclosing a broader range, i.e., the claimed narrow range is not disclosed with "sufficient specificity" in Goodboy to constitute anticipation. The final Official Action does not provide any reasons why the conditions set forth in MPEP §2131.03 have not been met.

There is well established legal precedent that overlapping ranges only presents a *prima facie* case of obviousness under 35 USC §103, not anticipation under 35 USC §102. As such, to the extent the discussion in MPEP §2131.03 of Ex parte Lee, 31 USPQ2d 1105

(BPAI 1993) suggests that overlapping ranges per se establishes anticipation, any such per se rule would be in conflict with a long line of CCPA and CAFC cases, some of which are discussed below.

Obviousness of ranges is discussed at MPEP §2144.05 wherein CCPA cases such as In re Wertheim, 191 USPQ 90 (CCPA 1976), and CAFC cases such as In re Woodruff, 16 USPQ2d 1934 (Fed. Cir. 1990) and In re Geisler, 43 USPQ2d 1362 (Fed. Cir. 1997) are discussed. In Woodruff, a prior art teaching of "about 1-5%" CO was held to overlap claims limited to "more than 5%", and in Geisler, a claimed thickness of "50 to 100 Angstroms" was held *prima facie* obvious over a reference teaching of not less than 100 Angstroms. The Woodruff and Geisler cases establish that an overlapping range presents a §103 issue rather than a §102 and that a rejection based on an overlapping range can be rebutted by showing criticality of the claimed range (see discussion at MPEP §2144.05 III. Rebuttal of *Prima Facie* Case of Obviousness). In the present case, the §102 rejection based on an overlapping range is improper and should be reversed.

Claim 1 sets forth an activated alumina catalyst comprising a cocatalytically effective amount of sodium values wherein the effective amount, expressed by weight of Na<sub>2</sub>O, ranges from 1,200 ppm to 2,500 ppm. Goodboy, on the other hand, relates to an activated catalyst having an overlapping sodium oxide content for purposes of providing resistance to sulfate poisoning (column 3, lines 10-33 of Goodboy). Goodboy states that a high sodium oxide content is beneficial for achieving low CO<sub>2</sub> chemisorption and the preferred amount of Na<sub>2</sub>O is 5000 ppm and above (see column 3, line 54 through column 4, line 22 of Goodboy). Goodboy does not disclose an activated alumina catalyst having a cocatalytically effective amount of sodium values for conversion of CS<sub>2</sub> wherein the effective amount is expressed by weight of Na<sub>2</sub>O ranging from 1200 to 2500 ppm. As such, Goodboy fails to disclose the combination of features recited in Claim 1.

Claim 7 recites that the activated alumina catalyst as defined by Claim 1 comprises extrudates, tablets, or beads thereof. Goodboy discloses that the catalysts according to the Goodboy invention are used in fixed or mobile beds with the dimensions of the constituent grains being adapted to the particular situation (see column 7, lines 1-4 of Goodboy). In

the Official Action, it is argued that Goodboy discloses "agglomerated particles (i.e., beads), the size of which can be adapted to a particular situation" (Official Action at page 2). The Official Action does not specifically address Claim 7. Because the Official Action does not apply Goodboy in a manner which would produce the combination of features recited in Claim 7, Claim 7 further patentably distinguishes the claimed invention over Goodboy in view of Dupin.

Claim 11 recites a catalyst comprising at least 0.5% by weight of an activated alumina catalyst comprising a cocatalytically effective amount of sodium values, said effective amount, expressed by weight of Na<sub>2</sub>O, ranging from 1,200 ppm to 2,700 ppm. The Official Action contends that Goodboy's overlapping range of 1000 ppm to 25000 ppm anticipates the range recited in Claim 11. Because the position taken in the Official Action is contrary to well established legal precedent (see MPEP § 716.02 (d) "Nonobviousness Of A Genus Or Claimed Range May Be Supported By Data Showing Unexpected Results Of A Species Or Narrow Range Under Certain Circumstances" (page 700-157), the combination of features recited in Claim 11 further patentably distinguishes the claimed invention over the prior art.

Claim 12 recites a catalyst comprising from 60% to 99% by weight of activated alumina catalyst comprising a cocatalytically effective amount of sodium values, said effective amount, expressed by weight of Na<sub>2</sub>O, ranging from 1,200 ppm to 2,700 ppm. The Official Action contends that Goodboy's overlapping range of 1000 ppm to 25000 ppm anticipates the range recited in Claim 12. Because the position taken in the Official Action is contrary to well established legal precedent (see MPEP § 716.02 (d) "Nonobviousness Of A Genus Or Claimed Range May Be Supported By Data Showing Unexpected Results Of A Species Or Narrow Range Under Certain Circumstances" (page 700-157), the combination of features recited in Claim 12 further patentably distinguishes the claimed invention over the prior art.

Claim 13 recites a process wherein a catalyzed Claus reaction is used for the production of elemental sulfur, the improvement comprising using as the catalyst therefor, an activated alumina catalyst comprising a cocatalytically effective amount of sodium

values, said effective amount, expressed by weight of Na<sub>2</sub>O, ranging from 1,200 ppm to 2,700 ppm. The Official Action alleges that Goodboy discloses a "Claus reaction" (Official Action at page 2) but does not specifically address Claim 13. As such, the combination of features recited in Claim 13 further patentably distinguishes the claimed invention over the prior art.

Claim 14 recites a process for the catalyzed hydrolysis of an organosulfur compound wherein the improvement comprises using as the catalyst therefor, an activated alumina catalyst comprising a cocatalytically effective amount of sodium values, said effective amount, expressed by weight of Na<sub>2</sub>O, ranging from 1,200 ppm to 2,700 ppm. The Official Action alleges that Goodboy discloses "that hydrolysis of organic sulfur compounds occurs" (Official Action at page 3) but does not specifically address Claim 14. As such, the combination of features recited in Claim 14 further patentably distinguishes the claimed invention over the prior art.

Claim 15 recites a process for catalytically removing objectionable sulfur compounds from gaseous effluents comprised thereof wherein the improvement comprises using as the catalyst therefor, an activated alumina catalyst comprising a cocatalytically effective amount of sodium values, said effective amount, expressed by weight of Na<sub>2</sub>O, ranging from 1,200 ppm to 2,700 ppm. The Official Action alleges that Goodboy "discloses a Claus reaction which necessarily results in the removal of sulfur compounds from gases" (sentence bridging pages 2-3 of Official Action) but does not specifically address Claim 15. As such, the combination of features recited in Claim 15 further patentably distinguishes the claimed invention over the prior art.

Claim 16 recites that the activated alumina catalyst as defined by Claim 1 has a specific surface of 350 to 370 m<sup>2</sup>/g. Although the Official Action alleges that "[i]t is desirable to have a specific surface greater than 300 m<sup>2</sup>/g" (Official Action at page 2), there is no teaching or suggestion in Goodboy to provide the activated alumina with a specific surface in the claimed range of 350 to 370 m<sup>2</sup>/g. As established by example 2 of Appellants' specification, when the specific surface is 360 m<sup>2</sup>/g ( $\pm 10$  m<sup>2</sup>/g), it is possible to achieve the unexpected improvement in conversion of CS<sub>2</sub> set forth in the Declaration

Under 37 CFR §1.132 by coinventor Christophe Nedez ("the Nedez Declaration") submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedez Declaration is insufficient to overcome the rejection of Claim 1 on the grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 16.

Claim 17 recites that the activated alumina catalyst as defined by Claim 11 has a specific surface of 350 to 370 m<sup>2</sup>/g. Although the Official Action alleges that "[i]t is desirable to have a specific surface greater than 300 m<sup>2</sup>/g" (Official Action at page 2), there is no suggestion in Goodboy to provide the activated alumina with a specific surface in the claimed range of 350 to 370 m<sup>2</sup>/g. As established by example 2 of Appellants' specification, when the specific surface is 360 m<sup>2</sup>/g ( $\pm 10$  m<sup>2</sup>/g), it is possible to achieve the unexpected improvement in conversion of CS<sub>2</sub> set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nedez ("the Nedez Declaration") submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedez Declaration is insufficient to overcome the rejection of Claim 1 on the grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 17.

Claim 18 recites that the activated alumina catalyst as defined by Claim 12 has a specific surface of 350 to 370 m<sup>2</sup>/g. Although the Official Action alleges that "[i]t is desirable to have a specific surface greater than 300 m<sup>2</sup>/g" (Official Action at page 2), there is no teaching or suggestion in Goodboy to provide the activated alumina with a specific surface in the claimed range of 350 to 370 m<sup>2</sup>/g. As established by example 2 of Appellants' specification, when the specific surface is 360 m<sup>2</sup>/g ( $\pm 10$  m<sup>2</sup>/g), it is possible to achieve the unexpected improvement in conversion of CS<sub>2</sub> set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nedez ("the Nedez Declaration") submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedez Declaration is insufficient to overcome the rejection of Claim 1 on the

grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 18.

Claim 19 recites that the activated alumina catalyst as defined by Claim 13 has a specific surface of 350 to 370 m<sup>2</sup>/g. Although the Official Action alleges that “[i]t is desirable to have a specific surface greater than 300 m<sup>2</sup>/g” (Official Action at page 2), there is no teaching or suggestion in Goodboy to provide the activated alumina with a specific surface in the claimed range of 350 to 370 m<sup>2</sup>/g. As established by example 2 of Appellants’ specification, when the specific surface is 360 m<sup>2</sup>/g ( $\pm 10$  m<sup>2</sup>/g), it is possible to achieve the unexpected improvement in conversion of CS<sub>2</sub> set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nedez (“the Nedez Declaration”) submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedez Declaration is insufficient to overcome the rejection of Claim 1 on the grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 19.

Claim 20 recites that the activated alumina catalyst as defined by Claim 14 has a specific surface of 350 to 370 m<sup>2</sup>/g. Although the Official Action alleges that “[i]t is desirable to have a specific surface greater than 300 m<sup>2</sup>/g” (Official Action at page 2), there is no teaching or suggestion in Goodboy to provide the activated alumina with a specific surface in the claimed range of 350 to 370 m<sup>2</sup>/g. As established by example 2 of Appellants’ specification, when the specific surface is 360 m<sup>2</sup>/g ( $\pm 10$  m<sup>2</sup>/g), it is possible to achieve the unexpected improvement in conversion of CS<sub>2</sub> set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nedez (“the Nedez Declaration”) submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedez Declaration is insufficient to overcome the rejection of Claim 1 on the grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 20.

Claim 21 recites that the activated alumina catalyst as defined by Claim 15 has a specific surface of 350 to 370 m<sup>2</sup>/g. Although the Official Action alleges that “[i]t is desirable to have a specific surface greater than 300 m<sup>2</sup>/g” (Official Action at page 2), there is no teaching or suggestion in Goodboy to provide the activated alumina with a specific surface in the claimed range of 350 to 370 m<sup>2</sup>/g. As established by example 2 of Appellants’ specification, when the specific surface is 360 m<sup>2</sup>/g ( $\pm 10$  m<sup>2</sup>/g), it is possible to achieve the unexpected improvement in conversion of CS<sub>2</sub> set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nedez (“the Nedez Declaration”) submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedez Declaration is insufficient to overcome the rejection of Claim 1 on the grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 21.

## IX. Argument II

### A. The §103 Rejection

Claims 4-6, 8, 9, 22 and 23 were rejected under 35 U.S.C. §103 as allegedly being unpatentable over Goodboy in view of Dupin. This rejection should be reversed for the following reasons.

### B. Legal Standard for § 103 Rejections

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). The teaching or suggestion to make the claimed combination and the reasonable expectation of success must

both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). Additionally, a prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984). See MPEP 2141.02.

Obviousness, however, can only be established by combining or modifying the teachings of the prior art to produce the claimed invention *where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art*. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). See MPEP 2143.01. Further, a statement that modifications of the prior art to meet the claimed invention would have been "well within the ordinary skill of the art at the time the claimed invention was made" because the references relied upon allegedly teach that all aspects of the claimed invention were individually known in the art is not sufficient to establish a *prima facie* case of obviousness without some objective reason to combine the teachings of the references. *Ex parte Levengood*, 28 USPQ2d 1300 (Bd. Pat. App. & Inter. 1993). See also *Al-Site Corp. v. VSI Int'l Inc.*, 174 F.3d 1308, 50 USPQ2d 1161 (Fed. Cir. 1999) (The level of skill in the art cannot be relied upon to provide the suggestion to combine references).

**C. Claimed Subject Matter Compared to Goodboy and Dupin**

Claim 4 recites that the activated alumina catalyst as defined by Claim 1 further comprises silica and/or at least one oxide of titanium, zirconium, cerium, tin, a rare earth, molybdenum, cobalt, nickel or iron. In the Official Action, it is acknowledged that Goodboy "does not disclose that the catalyst further comprises the components in claims 4-6..." (Official Action at page 4). The Official Action includes a discussion of Dupin but

does not specifically address Claim 4. Because Goodboy does not mention silica or "oxides" of Ti, Zr, Ce, Sn, a rare earth, Mo, Co, Ni or Fe and the Official Action does not apply Dupin in a manner which would cure the deficiencies of Dupin, Claim 4 further patentably distinguishes the claimed invention over Goodboy in view of Dupin.

Claim 5 recites that the activated alumina catalyst as defined by Claim 1 further comprises a clay, a silicate, an alkaline earth metal or ammonium sulfate, ceramic fibers, asbestos fibers, or combination thereof. In the Official Action, it is acknowledged that Goodboy "does not disclose that the catalyst further comprises the components in claims 4-6..." (Official Action at page 4). The Official Action includes a discussion of Dupin but does not specifically address Claim 5. Because the Official Action does not apply Dupin in a manner which would cure the deficiencies of Dupin, Claim 5 further patentably distinguishes the claimed invention over Goodboy in view of Dupin.

Claim 6 recites that the activated alumina catalyst as defined by Claim 1 further comprises cellulose, carboxymethyl cellulose, carboxyethyl cellulose, talol, a xanthan gum, a surface-active agent, a flocculating agent, a polyacrylamide, carbon black, a starch, stearic acid, polyacrylic alcohol, polyvinyl alcohol, a biopolymer, glucose, a polyethylene glycol, or combination thereof. In the Official Action, it is acknowledged that Goodboy "does not disclose that the catalyst further comprises the components in claims 4-6..." (Official Action at page 4). The Official Action includes a discussion of Dupin but does not specifically address Claim 6. Because the Official Action does not apply Dupin in a manner which would cure the deficiencies of Dupin, Claim 6 further patentably distinguishes the claimed invention over Goodboy in view of Dupin.

Claim 8 recites that the activated alumina catalyst as defined by Claim 7 comprises a plurality of beads having a diameter size ranging from 1.5 mm to 10 mm. In the Official Action, it is acknowledged that Goodboy "does not disclose the bead sizes of claims 8, 9, and 22..." (Official Action at page 4). The Official Action includes a discussion of Dupin but does not specifically address Claim 8. Because the Official Action does not apply Dupin in a manner which would cure the deficiencies of Dupin, Claim 8 further patentably distinguishes the claimed invention over Goodboy in view of Dupin.

Claim 9 recites that the beads as defined by Claim 8 have a diameter size ranging from 3 mm to 7 mm. In the Official Action, it is acknowledged that Goodboy "does not disclose the bead sizes of claims 8, 9, and 22..." (Official Action at page 4). The Official Action includes a discussion of Dupin but does not specifically address Claim 9. Because the Official Action does not apply Dupin in a manner which would cure the deficiencies of Dupin, Claim 9 further patentably distinguishes the claimed invention over Goodboy in view of Dupin.

Claim 22 sets forth that the activated alumina catalyst as defined by Claim 1 comprises beads having a diameter of 3.1 to 6.3 mm and specific surface area of 350 to 370 m<sup>2</sup>/g. Claim 22 was rejected over the combination of Goodboy and Dupin. In the Official Action, it is acknowledged that Goodboy "does not disclose the bead sizes of claims 8, 9, and 22..." (Official Action at page 4). The Official Action includes a discussion of Dupin but does not specifically address Claim 22. Because the Official Action does not apply Dupin in a manner which would cure the deficiencies of Dupin, Claim 22 further patentably distinguishes the claimed invention over Goodboy in view of Dupin. Further, as established by example 2 of Appellants' specification, when the specific surface is 360 m<sup>2</sup>/g ( $\pm 10$  m<sup>2</sup>/g) and the bead particle size is 3.1 to 6.3 mm, it is possible to achieve the unexpected improvement in conversion of CS<sub>2</sub> set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nede (the "Nede Declaration") submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nede Declaration is insufficient to overcome the rejection of Claim 1 on the grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nede Declaration is commensurate with the scope of Claim 22.

Claim 23 sets forth that the activated alumina catalyst as defined by Claim 1 comprises beads having (a) pore volume of alumina of pores of diameter greater than 0.1  $\mu$ m of 18.5 ml/100g and (b) pore volume of pores of alumina of diameter greater than 1  $\mu$ m of 15.5 ml/100g. Claim 23 was rejected over the combination of Goodboy and Dupin. In the Official Action, it is acknowledged that Goodboy "does not disclose the pore volume as

claimed in claim 23" (Official Action at page 4). The Official Action includes a discussion of Dupin but does not specifically address Claim 23. Because the Official Action does not apply Dupin in a manner which would cure the deficiencies of Dupin, Claim 23 further patentably distinguishes the claimed invention over Goodboy in view of Dupin. Further, as established by example 2 of Appellants' specification, when the pore volume of pores of diameter greater than 0.1  $\mu\text{m}$  is 18.5 ml/100 g of alumina and the pore volume of pores of diameter greater than 1  $\mu\text{m}$  is 15.5 ml/100 g of alumina, it is possible to achieve the unexpected improvement in conversion of CS<sub>2</sub> set forth in the Declaration Under 37 CFR §1.132 by coinventor Christophe Nedez ("the Nedez Declaration") submitted with the Preliminary Amendment filed on May 28, 1998. If the BPAI determines that the Nedez Declaration is insufficient to overcome the rejection of Claim 1 on the grounds that the showing of unexpected results is not commensurate with the scope of Claim 1, it is submitted that the showing in the Nedez Declaration is commensurate with the scope of Claim 22.

**D. Rebuttal Evidence For Overcoming §103 Rejection**

In In re Baird, 29 USPQ 2d 1550 (Fed. Cir. 1994), the court stated that "[t]he fact that a claimed compound may be encompassed by a disclosed generic formula does not by itself render that compound obvious." Also, evidence of unexpectedly good results can overcome a rejection based on optimization of a "result effective variable" provided the unexpected results are established by factual evidence. In re DeBlauwe, 222 USPQ 191, at 196 (Fed. Cir. 1994). With respect to optimization, in In re Antonie, 195 USPQ 6, 8 (CCPA 1977), the court stated that:

The PTO and the minority appear to argue that it will always be obvious for one of ordinary skill in the art to try varying every parameter of a system in order to optimize the effectiveness of the system even if there is no evidence in the record that the prior art recognized that particular parameter effected the result. As we have said many times, obvious to try is not the standard of 35 U.S.C. §103. (Emphasis in original.) Antonie, at 8.

The court in Antonie also stated that while the discovery of an optimum of a variable in a known process is normally obvious, there are two exceptions to the rule. The first exception is when the results of optimizing a variable, which was known to be result effective, were unexpectedly good. The second exception is in the case where the parameter optimized was not recognized to be a result-effective variable. In the present case, both exceptions apply since (1) the Nedez Declaration establishes unexpected improvement in CS<sub>2</sub> conversion over the claimed range and (2) Goodboy provides no recognition that low Na<sub>2</sub>O contents would be effective in providing improved CS<sub>2</sub> conversion rates.

Goodboy states that increased sulfur conversion can be obtained using an activated alumina catalyst in which sodium oxide concentration, LOI (hydroxyl content determined by heating from 400° to 1100°C) and surface area are controlled (column 3, lines 17-21 and 31-32 of Goodboy). Goodboy discloses a broad range of 0.1 to 2.5 wt % sodium oxide but prefers 0.50 to 2.5 wt % on a 1000°C calcined basis (column 3, lines 57-60 of Goodboy). Goodboy teaches away from low sodium oxide contents at column 4, lines 18-35 wherein it is stated "low sodium oxide content was believed to be desirable...[but contrary] to this expectation, significant amounts of sodium oxide are not only tolerable to a Claus catalyst, but , in fact, are beneficial . . ."

Goodboy's Examples 1-9 show a conversion rate of "S" of 79.1 to 82.9% for Na<sub>2</sub>O contents of 0.44, 1.36, 0.43, 0.41, 0.09, 2.10, 0.10 and 0.33 wt % (1000°C Basis) according to Table I of Goodboy. Such results would be plotted as an essentially flat curve, the conversion rate of 0.09 and 0.10 wt % Na<sub>2</sub>O being essentially the same as that of the 0.33 wt % and above Na<sub>2</sub>O contents. Further, it is noted that Goodboy measured SO<sub>2</sub> chemisorption rather than conversion of CS<sub>2</sub>.

It is well established that the unexpected discovery of improved results for a limited range within a broader range merits patent protection. See Baird, *supra*. In view of Goodboy's preference for Na<sub>2</sub>O contents in amounts of 0.5% and above and Goodboy's data showing essentially the same conversion rate for Na<sub>2</sub>O contents of 0.09 to 2.10%, the skilled artisan would not have expected low Na<sub>2</sub>O contents to produce the dramatic

improvement in CS<sub>2</sub> conversion discovered by Applicants. It is submitted that Appellants' showing of unexpected improvement in CS<sub>2</sub> conversion rates for the claimed range of 0.12 to 0.25% Na<sub>2</sub>O rebuts any *prima facie* case of obviousness based on Goodboy.

The Nedez Declaration includes Attachment I wherein CS<sub>2</sub> conversion is plotted with respect to various Na<sub>2</sub>O contents in a gas-catalyst prepared according to the process set forth in paragraph 2 of the Nedez Declaration. Attachment I shows the interpolated data corresponding CS<sub>2</sub> conversion rate for the closest Na<sub>2</sub>O examples of Goodboy compared to the claimed 1,200 to 2,500 ppm Na<sub>2</sub>O range (see paragraph 7 of the Nedez Declaration). Attachment I shows that the claimed 1,200 to 2,500 ppm Na<sub>2</sub>O content provides new and unexpected results with respect to CS<sub>2</sub> conversion compared to Na<sub>2</sub>O contents above and below the claimed range.

In the final Official Action, the only discussion of the Nedez Declaration is as follows:

"The argument that the Goodboy reference does not disclose applicant's claimed range of 1200 to 2500 ppm of sodium oxide with sufficient specificity to constitute anticipation is not persuasive because Goodboy's range of 0.1 to 2.5 wt% of sodium oxide is a preferred range. Since it is a preferred range, the examiner maintains that one having ordinary skill in the art would be directed by the disclosure of Goodboy to use amounts within the preferred disclosed range. Therefore, the evidence of unexpected results is irrelevant to overcoming the rejection." (Emphasis Added, Official Action at page 6).

The Official Action misreads Goodboy and totally ignores Applicants arguments set forth in the response filed June 26, 2000. As explained repeatedly throughout prosecution of the present application, Goodboy's preferred range is 0.50 to 2.5 wt %, the lower limit of the preferred range being two times greater than the upper end of Applicants' claimed range. Goodboy's lower end of the broad range of 0.1 to 2.5 wt % is lower than the lower end of the claimed range. Applicants claim a narrow range within the broad range of Goodboy and Applicants' evidence of unexpected results establishes patentability of the claimed narrow range.

The above quoted portion of the final Official Action is only pertinent to the rejection under §102 which has been addressed above. The present rejection is under §103 and Applicants are entitled to consideration of the submitted evidence of unexpected results. The position taken in the Official Action that the submitted evidence is "irrelevant" is clearly improper since MPEP §716.01 states that:

"[a]ll entered affidavits, declarations, and other evidence traversing rejections [must be] acknowledged and commented upon by the examiner in the next succeeding action [and] the examiner must specifically explain why the evidence is insufficient" (page 700-151).

In the present case, the Official Action dismisses the Nedez Declaration as "irrelevant" and no comments are provided as to the reasons why the Examiner considers the comparative data insufficient vis-a-vis the §103 rejections. Applicants have shown unexpectedly improved results for the narrow range of sodium oxide values according to the claimed invention. The Examiner has not commented on the sufficiency of the showing of unexpected results set forth in the Nedez Declaration. In view of the Examiner's failure to comment on the comparative data, it is submitted that the Nedez Declaration adequately rebuts any *prima facie* case of obviousness based on the combination of Goodboy and Dupin.

As set forth in MPEP § 716.02(e) "Comparison With Closest Prior Art," it is necessary to compare the claimed subject matter with the closest prior art to be effective to rebut a *prima facie* case of obviousness. In the present case, an examination of Exhibit I of the Nedez Declaration shows that the improvement of CS<sub>2</sub> conversion occurs over the entire claimed range and that the closest examples of Goodboy (900 ppm, 1000 ppm and 3300 ppm) do not achieve the unexpected improvement in CS<sub>2</sub> conversion achieved by Na<sub>2</sub>O contents within the claimed range. The Examiner has not commented on the sufficiency of the showing of unexpected results set forth in the Nedez Declaration. In view of the Examiner's failure to comment on the comparative data, it is submitted that the Nedez

Declaration adequately rebuts any *prima facie* case of obviousness based on the combination of Goodboy and Dupin.<sup>1</sup>

As set forth in MPEP § 716.02 “Allegations Of Unexpected Results,” it is necessary to determine whether the properties differ to such an extent that the difference is really unexpected. This portion of the MPEP cites In re Waymouth, 499 F.2d 1273, 182 USPQ 290, 293 (CCPA 1974) for the following test:

“. . . unexpected results for a claimed range as compared with the range disclosed in the prior art had been shown by a demonstration of a ‘marked improvement, over the results achieved under other ratios, as to be classified as a difference in kind, rather than one of degree.’”

A review of Exhibit I of the Nedez Declaration reveals that the CS<sub>2</sub> conversion drops off dramatically at values above 2700 ppm Na<sub>2</sub>O and below 1200 Na<sub>2</sub>O. Such results are truly unexpected in view of Goodboy’s preference for Na<sub>2</sub>O contents above 0.50 % (5000 ppm) in order to reduce SO<sub>2</sub> chemisorption upon the catalyst (see column 3, line 54 through column 4, line 6 of Goodboy). Goodboy discloses that “[i]n order to achieve low SO<sub>2</sub> chemisorption . . . high sodium oxide content [is] beneficial” (see column 4, lines 18-22 of Goodboy). Accordingly, while Goodboy discloses an overlapping range of Na<sub>2</sub>O, Goodboy teaches away from the claimed range which Appellants have shown produces unexpected improvement in CS<sub>2</sub> conversion a result not mentioned in Goodboy. The Examiner has not commented on the showing of unexpected results set forth in the Nedez Declaration. In view of the Examiner’s failure to comment on the comparative data, it is submitted that the Nedez Declaration adequately rebuts any *prima facie* case of obviousness based on the combination of Goodboy and Dupin.

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<sup>1</sup> In a prior Official Action it was stated that “[a] skilled artisan would recognize that the amount of sodium oxide required for optimum results would differ for each of said recited compounds” and that depending on the process for which the catalyst is to be employed, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to have determined the optimum concentration of sodium oxide because sodium oxide is a recognized result-effective parameter” (Official Action dated May 27, 1999 at pages 6-7). The final Official Action abandons this prior position in favor of the untenable anticipation theory.

**X. Argument III**

**A. The Second § 103 Rejection**

Claim 10 stands rejected under 35 U.S.C. §103 over Goodboy in view of U.S. Patent No. 5,242,673 ("Flytzani-Stephanopoulos"). The rejection should be reversed for the following reasons.

**B. The Claimed Subject Matter**

Claim 10 recites that the activated alumina catalyst as defined by Claim 1 is deposited onto a support substrate therefor.

**C. Reasons Claim 10 is Patentable Over the Cited References**

In the Official Action, it is acknowledged that Goodboy "does not disclose that the alumina catalyst is deposited on a support substrate" (Official Action at page 5). Flytzani-Stephanopolous is cited for a disclosure that "sulfur recovery catalysts that contain aluminum oxide may be deposited on supports" (Official Action at page 6). Although the Official Action argues that it would have been obvious to modify Goodboy "by supporting the catalyst as suggested by Flytzani-Stephanopolous" (Official Action at page 6), the result of such a modification of Goodboy would be an impermissible change in the principle of operation of Goodboy's catalyst. See MPEP § 2143.01 and 2145 III (page 2100-121). That is, Goodboy discloses that the activated alumina is "agglomerated" and "may also be used as a catalyst base (support) to which small quantities of compounds known to enhance specific properties of the catalyst may be added" (column 6, lines 23-68 of Goodboy). The agglomerates are used in "a fixed or mobile bed or fluid bed or with aerial suspension, the dimensions of the constituent grains being adapted to the particular situation" (column 7, lines 1-4 of Goodboy). Accordingly, Goodboy's activated alumina must be used as a particle and not as a deposit on a support substrate. Modifying Goodboy to provide the activated alumina as a deposit would clearly change the principle of Goodboy's invention. Because MPEP § 2143.01 states that the modification proposed in the Official Action may

not change the principle of operation of the primary reference, the combination of features recited in Claim 10 further patentably distinguishes the claimed invention over the prior art.

**XI. Conclusion**

From the foregoing Arguments I, II and III, it is submitted that the § 102 rejection is improper because Goodboy does not disclose a single example falling within the claimed range of sodium oxide values and any *prima facie* case of obviousness based on Goodboy alone or based on the combination of Goodboy and Dupin or Goodboy and Flytzani-Stephanopolous is overcome by the showing of unexpected results set forth in the Nedez Declaration, i.e., the claimed Na<sub>2</sub>O range produces unexpected improvement in CS<sub>2</sub> conversion in comparison to the closest examples (interpolated using Attachment I of the Nedez Declaration) of Goodboy. Accordingly, reversal of the three grounds of rejection set forth in the final Official Action is respectfully requested.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

By: Peter K. Skiff  
Peter K. Skiff  
Registration No. 31,917

P.O. Box 1404  
Alexandria, Virginia 22313-1404  
(703) 836-6620

Date: March 15, 2001

## **APPENDIX**

### **The Appealed Claims**

1. An activated alumina catalyst comprising a cocatalytically effective amount of sodium values for conversion of CS<sub>2</sub>, said effective amount, expressed by weight of Na<sub>2</sub>O, ranging from 1,200 ppm to 2,500 ppm.
2. The activated alumina catalyst as defined by Claim 1, said effective amount, expressed by weight of Na<sub>2</sub>O, ranging from 1,500 ppm to 2,500 ppm.
3. The activated alumina catalyst as defined by Claim 2, said effective amount, expressed by weight of Na<sub>2</sub>O, ranging from 1,700 ppm to 2,200 ppm.
4. The activated alumina catalyst as defined by Claim 1, further comprising silica and/or at least one oxide of titanium, zirconium, cerium, tin, a rare earth, molybdenum, cobalt, nickel or iron.
5. The activated alumina catalyst as defined by Claim 1, further comprising a clay, a silicate, an alkaline earth metal or ammonium sulfate, ceramic fibers, asbestos fibers, or combination thereof.
6. The activated alumina catalyst as defined by Claim 1, further comprising cellulose, carboxymethyl cellulose, carboxyethyl cellulose, talol, a xanthan gum, a surface-active agent, a flocculating agent, a polyacrylamide, carbon black, a starch, stearic acid,

polyacrylic alcohol, polyvinyl alcohol, a biopolymer, glucose, a polyethylene glycol, or combination thereof.

7. The activated alumina catalyst as defined by Claim 1, comprising extrudates, tablets, or beads thereof.

8. The activated alumina catalyst as defined by Claim 7, comprising a plurality of beads having a diameter size ranging from 1.5 mm to 10 mm.

9. The activated alumina catalyst as defined by Claim 8, said beads having a diameter size ranging from 3 mm to 7 mm.

10. The activated alumina catalyst as defined by Claim 1, deposited onto support substrate therefor.

11. A catalyst comprising at least 0.5% by weight of an activated alumina catalyst comprising a cocatalytically effective amount of sodium values, said effective amount, expressed by weight of Na<sub>2</sub>O, ranging from 1,200 ppm to 2,700 ppm.

12. A catalyst comprising from 60% to 99% by weight of activated alumina catalyst comprising a cocatalytically effective amount of sodium values, said effective amount, expressed by weight of Na<sub>2</sub>O, ranging from 1,200 ppm to 2,700 ppm.

13. In a catalyzed Claus reaction for the production of elemental sulfur, the improvement which comprises, as the catalyst therefor, an activated alumina catalyst comprising a cocatalytically effective amount of sodium values, said effective amount, expressed by weight of  $\text{Na}_2\text{O}$ , ranging from 1,200 ppm to 2,700 ppm.

14. In a process for the catalyzed hydrolysis of an organosulfur compound, the improvement which comprises, as the catalyst therefor, an activated alumina catalyst comprising a cocatalytically effective amount of sodium values, said effective amount, expressed by weight of  $\text{Na}_2\text{O}$ , ranging from 1,200 ppm to 2,700 ppm.

15. In a process for catalytically removing objectionable sulfur compounds from gaseous effluents comprised thereof, the improvement which comprises, as the catalyst therefor, an activated alumina catalyst comprising a cocatalytically effective amount of sodium values, said effective amount, expressed by weight of  $\text{Na}_2\text{O}$ , ranging from 1,200 ppm to 2,700 ppm.

16. The activated alumina catalyst as defined by Claim 1, wherein the catalyst has a specific surface of 350 to 370  $\text{m}^2/\text{g}$ .

17. The catalyst as defined by Claim 11, wherein the catalyst has a specific surface of 350 to 370  $\text{m}^2/\text{g}$ .

18. The catalyst as defined by Claim 12, wherein the catalyst has a specific surface of 350 to 370 m<sup>2</sup>/g.

19. The reaction as defined by Claim 13, wherein the catalyst has a specific surface of 350 to 370 m<sup>2</sup>/g.

20. The process as defined by Claim 14, wherein the catalyst has a specific surface of 350 to 370 m<sup>2</sup>/g.

21. The process as defined by Claim 15, wherein the catalyst has a specific surface of 350 to 370 m<sup>2</sup>/g.

22. The activated alumina catalyst as defined by Claim 1, comprising beads having a diameter of 3.1 to 6.3 mm and specific surface area of 350 to 370 m<sup>2</sup>/g.

23. The activated alumina catalyst as defined by Claim 1, comprising beads having pore volume of alumina of pores of diameter greater than 0.1  $\mu$ m of 18.5 ml/100g and pore volume of pores of alumina of diameter greater than 1  $\mu$ m of 15.5 ml/100g.